**TP-116-03**
**March 12, 1993**

# U.S. DEPARTMENT OF TRANSPORTATION

## NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

# LABORATORY TEST PROCEDURE

# FOR

# FMVSS 116

# Motor Vehicle Brake Fluids

**SAFETY ASSURANCE**
**Office of Vehicle Safety Compliance**
**Room 6115, NSA-30**
**400 Seventh Street, SW**
**Washington, DC 20590**

# OVSC LABORATORY TEST PROCEDURE NO. 116
# TABLE OF CONTENTS

## 1. PURPOSE AND APPLICATION

The Office of Vehicle Safety Compliance (OVSC) provides contracted laboratories with Laboratory Test Procedures (TPs) which serve as guidelines for obtaining compliance test data. The data are used to determine if a specific vehicle or item of motor vehicle equipment meets the minimum performance requirements of the subject Federal Motor Vehicle Safety Standard (FMVSS). The purpose of the OVSC Laboratory Test Procedures is to present a uniform testing and data recording format, and provide suggestions for the use of specific equipment and procedures. Any contractor interpreting any part of an OVSC Laboratory Test Procedure to be in conflict with a Federal Motor Vehicle Safety Standard or observing any deficiencies in a Laboratory Test Procedure is required to advise the Contracting Officer's Technical Representative (COTR) and resolve the discrepancy prior to the start of compliance testing.

Contractors are required to submit a detailed test procedure to the COTR before initiating the compliance test program. The procedure must include a step-by-step description of the methodology to be used.

The OVSC Laboratory Test Procedures are not intended to limit or restrain a contractor from developing or utilizing any testing techniques or equipment which will assist in procuring the required compliance test data.

**NOTE:**

**The OVSC Laboratory Test Procedures, prepared for use by independent laboratories under contract to conduct compliance tests for the OVSC, are not intended to limit the requirements of the applicable FMVSS(s). In some cases, the OVSC Laboratory Test Procedures do not include all of the various FMVSS minimum performance requirements. Sometimes, recognizing applicable test tolerances, the Test Procedures specify test conditions which are less severe than the minimum requirements of the standards themselves. Therefore, compliance of a vehicle or item of motor vehicle equipment is not necessarily guaranteed if the manufacturer limits certification tests to those described in the OVSC Laboratory Test Procedures.**

## 2. GENERAL REQUIREMENTS

FMVSS 116 specifies requirements for fluids for use in hydraulic brake systems of motor vehicles, containers for these fluids, and labeling of the containers.

The purpose of S116 is to reduce failures in the hydraulic braking systems of motor vehicles which may occur because of the manufacture or use of improper or contaminated fluid.

The standard applies to all fluid for use in hydraulic brake systems of passenger cars, multipurpose passenger vehicles, trucks, buses, trailers, and motorcycles which are equipped with a hydraulic brake system. The fluid for use in the referenced vehicle shall have been manufactured and packaged in conformity with the requirements of S116. The tests which are contained within this test procedure are used to determine compliance with the specified requirements. These tests are as follows:

A. Equilibrium Reflux Boiling Point (ERBP)
B. Wet ERBP
C. Kinematic Viscosity
D. Ph Value
E. Fluid Stability
F. Corrosion
G. Fluidity and Appearance (Low Temperature)
H. Evaporation
I. Water Tolerance
J. Compatibility
K. Resistance to Oxidation
L. Effect on SBR Cups
M. Stroking Properties (This test is only conducted when specifically specified in the contract)
N. Container Information

## 3. SECURITY

The contractor shall provide appropriate security measures to protect the OVSC test equipment from unauthorized personnel during the entire compliance testing program. The contractor is financially responsible for any acts of theft and/or vandalism which occur during the storage of test equipment. Any security problems which arise shall be reported by telephone to the Industrial Property Manager (IPM), Office of Contracts and Procurement, within two working days after the incident. A letter containing specific details of the security problem will be sent to the IPM (with copy to the COTR) within 48 hours.

The contractor shall protect and segregate the data that evolves from compliance testing before and after each test. No information concerning the safety compliance testing program shall be released to anyone except the COTR, unless specifically authorized by the COTR, the COTR's Branch or Division Chief, or by the Contracting Officer.

**NO INDIVIDUALS, OTHER THAN CONTRACTOR PERSONNEL, SHALL BE ALLOWED TO WITNESS ANY COMPLIANCE TEST UNLESS SPECIFICALLY AUTHORIZED BY THE COTR.**

## 4. GOOD HOUSEKEEPING

Contractors shall maintain the entire equipment compliance testing area, test fixtures and instrumentation in a neat and clean condition with test instruments arranged in an orderly manner consistent with good test laboratory housekeeping practices.

## 5. TEST SCHEDULING AND MONITORING

The contractor shall submit a test schedule to the COTR prior to testing. Tests shall be completed as required in the contract. All testing shall be coordinated to allow monitoring by the COTR.

## 6. TEST DATA DISPOSITION

The contractor shall make all equipment preliminary compliance test data available to the COTR on location within four hours after the test. Final test data, including digital printouts and computer generated plots (if applicable), shall be furnished to the COTR in accordance with the contract schedule.

All backup data sheets, strip charts, recordings, plots, technicians notes, etc., shall be retained by the contractor for a minimum of five years after conclusion of each delivery order, purchase order, etc. The COTR shall direct final disposition at that time.

## 7. GOVERNMENT FURNISHED PROPERTY (GFP) AND TEST SAMPLES

TEST SAMPLE IDENTIFICATION AND STORAGE

Upon receipt at the laboratory, the items to be tested shall be assigned laboratory serial numbers.

EXAMPLE:

Brand X Heavy Duty Brake Fluid; Lab Group #00X

An inventory shall be made of the number, name and condition of samples received.

The test samples shall be stored in a dry and clean area specifically designated by the Laboratory Project Manager.

## 8. CALIBRATION OF TEST INSTRUMENTS

Before the contractor initiates the safety compliance test program, a test instrumentation calibration system will be implemented and maintained in accordance with established calibration practices. Guidelines for setting up and maintaining such calibration systems are described in MIL-C-45662A, "Calibration System Requirements". The calibration system shall be set up and maintained as follows:

A. Standards for calibrating the measuring and test equipment will be stored and used under appropriate environmental conditions to assure their accuracy and stability.

B. All measuring instruments and standards shall be calibrated by the contractor, or a commercial facility, against a higher order standard at periodic intervals NOT TO EXCEED TWELVE (12) MONTHS except for static types of measuring devices such as rulers, weights, etc., which shall be calibrated at periodic intervals not to exceed two years. Records, showing the calibration traceability to the National Institute of Standards and Technology (NIST), shall be maintained for all measuring and test equipment.

C. All measuring and test equipment and measuring standards will be labeled with the following information:

(1) Date of calibration
(2) Date of next scheduled calibration

D. A written calibration procedure shall be provided by the contractor which includes as a minimum the following information for all measurement and test equipment unless the calibration is performed by a licensed commercial facility.

(1) Type of equipment, manufacturer, model number, etc.
(2) Measurement range
(3) Accuracy
(4) Calibration interval
(5) Type of standard used to calibrate the equipment (calibration traceability of the standard must be evident)

E. Records of calibration for all test instrumentation shall be kept by the contractor in a manner which assures the maintenance of established calibration schedules. All such records shall be readily available for inspection when requested by the COTR. The calibration system will need the acceptance of the COTR before the test program commences.

## 9. PHOTOGRAPHIC DOCUMENTATION

Each final test report shall include glossy photographs (minimum size 4 x 6 inches) of the test setup used for each phase of testing. One set of original photographs shall be included in the final test report which will be used for optical scanning by the OVSC. Other copies of the final test report may contain multilith or other suitable photographic copies of the original photographs.

## 10. DEFINITIONS

### BLISTER

Cavity or sac on the surface of a brake cup.

### BRAKE FLUID

Liquid designed for use in a motor vehicle hydraulic brake system in which it will contact elastomeric components made of styrene and butadiene rubber (SBR), ethylene and propylene rubber (EPR), polychloroprene (CR) brake hose inner tube stock or natural rubber (NR).

### CHIPPING

Condition in which small pieces are missing from the outer surface of a brake cup.

### DUPLICATE SAMPLES

Two samples of brake fluid taken from a single packaged lot and tested simultaneously.

### HYDRAULIC SYSTEM MINERAL OIL

Mineral-oil-based fluid designed for use in motor vehicle hydraulic brake systems in which the fluid is not in contact with components made of SBR, EPR or NR.

### PACKAGED LOT

That quantity of brake fluid shipped by the manufacturer to the packager in a single container, or that quantity of brake fluid manufactured by a single plant run of 24 hours or less, through the same processing equipment and with no change in ingredients.

### PACKAGER

Person who fills containers with brake fluid that are distributed for retail sale.

### SCUFFING

Visible erosion of a portion of the outer surface of a brake cup.

### SILICONE BASE BRAKE FLUID (SBBF)

A brake fluid which consists of not less than 70 percent by weight of a diorgano polysiloxane.

## 10. DEFINITIONS....Continued

### SLOUGHING

Degradation of a brake cup as evidenced by the presence of carbon black loosely held on the brake cup surface, such that a visible black streak is produced when the cup, with a 500 ± 10 gram dead weight on it, is drawn base down over a sheet of white bond paper placed on a firm flat surface.

### STICKINESS

Condition on the surface of a brake cup such that fibers will be pulled from a wad of U.S.P. absorbent cotton when it is drawn across the surface.

## 11. PRETEST REQUIREMENTS

### IN-HOUSE TEST PROCEDURE

Prior to conducting any compliance test, contractors are required to submit a detailed in-house compliance test procedure to the COTR which includes a step-by-step description of the methodology to be used. Written approval must be obtained from the COTR before initiating the compliance test program so that all parties are in agreement.

### TEST DATA LOSS

A compliance test is not to be conducted unless all of the various test conditions specified in the applicable OVSC Laboratory Test Procedure have been met. Failure of a contractor to obtain the required test data and to maintain acceptable limits on test parameters in the manner outlined in the applicable OVSC Laboratory Test Procedure may require a retest at the expense of the contractor. The retest costs will include the cost of the replacement brake fluid and all costs associated with conducting the retest.

The Contracting Officer of NHTSA is the only NHTSA official authorized to notify the contractor that a retest is required. The retest shall be completed within two (2) weeks after receipt of notification by the Contracting Officer that a retest is required. If a retest is conducted, no test report is required for the original test.

### TEST CONDITIONS

Unless otherwise specified, all tests and measurements shall be conducted under the following environmental conditions:

| | | |
|---|---|---|
| A. | Temperature | 75ºF ± 15ºF |
| B. | Relative Humidity | 50% ± 10% |
| C. | Atmospheric Pressure | 28 to 32 inches of mercury |

Continuous recording of environmental temperature and relative humidity of the testing area shall be available during all tests. Test samples, unless otherwise specified, shall be stabilized at test room conditions for a period of at least 24 hours immediately prior to testing.

### TEST PERSONNEL PERFORMANCE

Personnel supervising and/or performing the compliance test program shall be thoroughly familiar with the requirements, test conditions, equipment for the test to be conducted, and safety requirements.

## 11. PRETEST REQUIREMENTS....Continued

### RECORDING OF TEST DATA

Environmental data and test data shall be recorded on permanent strip charts, circular recording charts, or other acceptable print-out media. Where permanent trace recording is not required, data will be recorded on standard report forms. Changes or corrections shall be made by drawing a line through the original entry, which must still remain legible, and adding the change alongside.

Test data will be submitted on the standard form Test Data Sheets specified for use in the final test report and shown in Section 15. Data will be typed before the sheets are submitted. If stroking test is conducted, Data Sheet No. 3 shall be used.

## 12. COMPLIANCE TEST EXECUTION

### TEST METHODS

The methods and procedures to be used shall be those specified in S116, effective March 1, 1972, and amendments thereto.

### TEST QUANTITIES

The amount of brake fluid required for one complete test group is shown below:

| TEST | | QUANT. |
|---|---|---|
| S6.1 | Equilibrium Reflux Boiling Point (ERBP) | 125 ml |
| S6.2 | Wet ERBP | 205 ml |
| S6.3 | Kinematic Viscosity | 120 ml |
| S6.4 | pH Value | 55 ml |
| S6.5 | Fluid Stability | 125 ml |
| S6.6 | Corrosion | 1520 ml |
| S6.7 | Fluidity & Appearance (Low Temp.) | 205 ml |
| S6.8 | Evaporation | 95 ml |
| S6.9 | Water Tolerance | 105 ml |
| S6.10 | Compatibility | 55 ml |
| S6.11 | Resistance to Oxidation | 65 ml |
| S6.12 | Effect on SBR Cups | 150 ml |
| S6.13 | Stroking Properties | 3785 ml |
| S6.14 | Container Information | 348 ml |
| | Reserve | 2850 ml |
| | TOTAL | 9808 ml |
| | | (338 oz) |

### TEST REQUIREMENTS

The fluid samples shall meet specific requirements when tested in accordance with the procedures in S116.

### TEST PERFORMANCE

The test program shall be conducted by more than one person in the laboratory to assure that monitoring of the program can be continuous, complete, and expeditious, unless automated equipment is used. Test technicians shall be aware of all requirements for each test phase which is being performed.

### TEST SAMPLE IDENTIFICATION AND STORAGE

All containers of a sample used for any single test shall be identically labeled and shall have the same lot code. Each container shall be tightly sealed after a small

## 12. COMPLIANCE TEST EXECUTION....Continued

quantity of fluid has been removed, to prevent changes in fluid characteristics which might adversely affect test results.

The following data shall be recorded for each test sample. If different lot codes are used for each test, the codes shall be recorded on the data entry for that test.

A. Name of manufacturer, distributor, packager, and the mailing address if this information is on the container.

B. Packaged lot and date of packaging (may be in a coded form).

C. DOT grade.

All containers of test samples must be stored in a clean, dry, security storage area to prevent deterioration of the fluids in any manner which may affect test results.

### RECORDING OF DATA

Test data shall be recorded on permanent strip charts, circular recording charts, or other acceptable printout media. Where permanent trace recording is not required, data will be recorded on standard report forms. Changes or corrections shall be made by drawing a line through the original entry, which must still remain legible, and adding the change alongside.

### PARTS DATA AND SUMMARY OF RESULTS

On the brake fluid information section of the Compliance Data Summary in the final report, each space shall be filled out. Where information is not available, write "None".

The summary of results shall indicate pass or fail of each phase of the test program as supported by the results tabulated on the test data sheets.

### TEST DATA REPORTING FORMS

Data will be submitted on the Test Data Sheet forms specified for use in the final report. Data will be typed before the sheets are submitted.

## 13. POST TEST REQUIREMENTS

The contractor shall re-verify all instrumentation and check data sheets and photographs. Make sure that data is recorded in all applicable data blocks on every Data Sheet.

# 14. REPORTS

## 14.1 MONTHLY STATUS REPORTS

The contractor shall submit a monthly Test Status Report and an Equipment Status Report to the COTR. The Equipment Status Report shall be submitted until all items of equipment are disposed of. Samples of the required Monthly Status Reports are contained in the report forms section.

## 14.2 TEST FAILURE

Any indication of a test failure shall be communicated by telephone to the COTR within 1 working day with written notification mailed within 2 working days. A Notice of Test Failure (see report forms section) with a copy of the particular compliance test data sheet(s) and preliminary data plot(s) shall be included. In the event of a test failure, a post test calibration check of some critically sensitive test equipment and instrumentation may be required for verification of accuracy. The necessity for the calibration shall be at the COTR's discretion and shall be performed without additional costs to the OVSC.

## 14.3 FINAL TEST REPORTS

### 14.3.1 COPIES

In the case of a test failure, **SEVEN** copies of the Final Test Report shall be submitted to the COTR for acceptance within three weeks of test completion. The Final Test Report format to be used by all contractors can be found in the attachment.

Where there has been no indication of a test failure, **FOUR** copies of each Final Test Report shall be submitted to the COTR within three weeks of test completion. Payment of contractor's invoices for completed compliance tests may be withheld until the Final Test Report is accepted by the COTR. Contractors are requested to NOT submit invoices before the COTR is provided copies of the Final Test Report.

Contractors are required to submit the first Final Test Report in typed draft form within two weeks after the compliance test is conducted. The contractor and the COTR will then be able to discuss the details of both test conduct and report content early in the compliance test program.

Contractors are required to PROOF READ all Final Test Reports before submittal to the COTR. The OVSC will not act as a report quality control office for contractors. Reports containing a significant number of errors will be returned to the contractor for correction, and a "hold" will be placed on invoice payment for the particular test.

## 14. REPORTS....Continued

14.3.2 REQUIREMENTS

The Final Test Report, associated documentation (including photographs) are relied upon as the chronicle of the compliance test. The Final Test Report will be released to the public domain after review and acceptance by the COTR. For these reasons, each final report must be a complete document capable of standing by itself. The contractor should use detailed descriptions of all compliance test events. Any events that are not directly associated with the standard but are of technical interest should also be included. The contractor should include as much **detail** as possible in the report. Instructions for the preparation of the first three pages of the final test report are provided below for the purpose of standardization.

14.3.3 FIRST THREE PAGES

A. FRONT COVER

A heavy paperback cover (or transparency) shall be provided for the protection of the final report. The information required on the cover is as follows:

(1) Final Report Number such as 116-ABC-9X-001

where —

116 is the FMVSS tested
ABC are the initials for the laboratory
9X is the Fiscal Year of the test program
001 is the Group Number (001 for the 1st brand, 002 for the 2nd brand, etc.)

(2) Final Report Title And Subtitle such as

SAFETY COMPLIANCE TESTING FOR FMVSS 116
Motor Vehicle Brake Fluid
* * * * * * * * * * * * * * * *
ACE Distributors
Little Tiger DOT 3 H.D. Brake Fluid

(3) Contractor's Name and Address such as

COMPLIANCE TESTING LABORATORIES, INC.
4335 West Dearborn Street
Detroit, Michigan 48090-1234

**14. REPORTS....Continued**

NOTE: DOT SYMBOL WILL BE PLACED BETWEEN ITEMS (3) AND (4)

(4) Date of Final Report completion

(5) The words "FINAL REPORT"

(6) The sponsoring agency's name and address as follows

U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Safety Assurance
Office of Vehicle Safety Compliance
Room 6115 (NSA-32)
400 Seventh Street, SW
Washington, DC 20590

**14. REPORTS....Continued**

B. FIRST PAGE AFTER FRONT COVER

A disclaimer statement and an acceptance signature block for the COTR shall be provided as follows

This publication is distributed by the U. S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof. If trade or manufacturers' names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Prepared By: _____

Approved By: _____

Approval Date_____

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted By: _____

Acceptance Date:_____

## 14. REPORTS....Continued

C. SECOND PAGE AFTER FRONT COVER
A completed Technical Report Documentation Page (Form DOT F1700.7) shall be completed for those items that are applicable with the other spaces left blank. Sample data for the applicable block numbers of the title page follows.

**Block 1 — REPORT NUMBER**

116-ABC-9X-001

**Block 2 — GOVERNMENT ACCESSION NUMBER**

Leave blank

**Block 3 — RECIPIENT'S CATALOG NUMBER**

Leave blank

**Block 4 — TITLE AND SUBTITLE**

Final Report of FMVSS 116 Compliance Testing of Little Tiger DOT 3 Heavy Duty Brake Fluid

**Block 5 — REPORT DATE**

March 1, 199X

**Block 6 — PERFORMING ORGANIZATION CODE**

ABC

**Block 7 — AUTHOR(S)**

John Smith, Project Manager / Bill Doe, Project Engineer

**Block 8 — PERFORMING ORGANIZATION REPORT NUMBER**

ABC-DOT-XXX-001

**Block 9 — PERFORMING ORGANIZATION NAME AND ADDRESS**

ABC Laboratories
405 Main Street
Detroit, MI 48070-1234

## 14. REPORTS....Continued

### Block 10 — WORK UNIT NUMBER

Leave blank

### Block 11 — CONTRACT OR GRANT NUMBER

DTNH22-9X-D-12345

### Block 12 — SPONSORING AGENCY NAME AND ADDRESS

US Department of Transportation
National Highway Traffic Safety Administration
Safety Assurance
Office of Vehicle Safety Compliance (NSA-32)
400 Seventh Street, SW, Room 6115
Washington, DC 20590

### Block 13 — TYPE OF REPORT AND PERIOD COVERED

Final Test Report
Feb. 15 to Mar. 15, 199X (Start Date to Completion Date)

### Block 14 — SPONSORING AGENCY CODE

NSA-30

### Block 15 — SUPPLEMENTARY NOTES

Leave blank

### Block 16 — ABSTRACT

Compliance tests were conducted on Little Tiger DOT 3 H.D. Brake Fluid in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-116-XX for the determination of FMVSS 116 compliance. Test failures identified were as follows:

None

**NOTE:** Above wording must be shown with appropriate changes made for a particular compliance test. Any questions should be resolved with the COTR.

## 14. REPORTS....Continued

### Block 17 — KEY WORDS

Compliance Testing
Safety Engineering
FMVSS 116

### Block 18 — DISTRIBUTION STATEMENT

Copies of this report are available from —

National Highway Traffic Safety Administration
Technical Reference Division
Room 5108 (NAD-52)
400 Seventh Street, SW
Washington, DC 20590
Telephone No.: 202-366-4946

### Block 19 — SECURITY CLASSIFICATION OF REPORT

Unclassified

### Block 20 — SECURITY CLASSIFICATION OF PAGE

Unclassified

### Block 21 — NUMBER OF PAGES

Add appropriate number

### Block 22 — PRICE

Leave blank

## 14. REPORTS....Continued

13.3.4 TABLE OF CONTENTS

Final test report Table of Contents shall include the following:

A. Section 1 — Purpose of Compliance Test

B. Section 2 — Compliance Test Data Summary

C. Section 3 — Test Data

D. Section 4 — Test Failure Details (if applicable)

E. Appendix A — Interpretations or Deviations From FMVSS 116

F. Appendix B — Test Equipment List and Calibration Information

G. Appendix C — Photographs

## 15. DATA SHEETS

### DATA SHEET 1
### SUMMARY OF TEST RESULTS

GROUP NO.: _____ ; LAB.: _____

BRAKE FLUID BRAND: _____

DISTRIBUTOR: _____

ADDRESS: _____

LOT I.D./PACKAGE CODE: _____ ; DOT GRADE: _____

| **INDICATE P - PASS OR F - FAIL** | **PASS** | **FAIL** |
|---|---|---|
| 1. Boiling Point (ERBP) | _____ | _____ |
| 2. Wet ERBP | _____ | _____ |
| 3. Viscosity at -40ºF | _____ | _____ |
| Viscosity at 212ºF | _____ | _____ |
| 4. pH Value | _____ | _____ |
| 5. Fluid Stability | _____ | _____ |
| 6. Corrosion: | | |
| Weight Change, mg/cm² | | |
| Tinned Iron | _____ | _____ |
| Steel | _____ | _____ |
| Aluminum | _____ | _____ |
| Cast Iron | _____ | _____ |
| Brass | _____ | _____ |
| Copper | _____ | _____ |
| Pitting or Roughening | _____ | _____ |
| Jelling of Mixture | _____ | _____ |
| Crystalline Deposit | _____ | _____ |
| Sedimentation, % by volume | _____ | _____ |
| Disintegration of cups | _____ | _____ |
| pH after test | _____ | _____ |
| Decrease in cup hardness | _____ | _____ |
| Increase in cup diameter | _____ | _____ |

(Continued on next page)

**15. DATA SHEETS....Continued**

| **INDICATE P - PASS OR F - FAIL** | **PASS** | **FAIL** |
|---|---|---|
| 7. Fluidity and Appearance at Low Temperature: | | |
| Crystallization at -40ºF | _____ | _____ |
| Crystallization at -58ºF | _____ | _____ |
| Sedimentation at -40ºF | _____ | _____ |
| Sedimentation at -58ºF | _____ | _____ |
| Air Bubble Rise Time at -40ºF | _____ | _____ |
| Air Bubble Rise Time at -58ºF | _____ | _____ |
| 8. Evaporation: | | |
| Percent weight loss | _____ | _____ |
| Gritty Precipitate | _____ | _____ |
| Pour point of residue | _____ | _____ |
| 9. Water Tolerance: | | |
| Stratification at -40ºF | _____ | _____ |
| Stratification at 140ºF | _____ | _____ |
| Sedimentation at -40ºF | _____ | _____ |
| Sedimentation at 140ºF | _____ | _____ |
| Air Bubble Rise Time at -40ºF | _____ | _____ |
| 10. Compatibility: | | |
| Stratification, Crystallization | _____ | _____ |
| Sedimentation, Sludging | _____ | _____ |
| 11. Resistance to Oxidation: | | |
| Weight loss, mg/cm² | | |
| Aluminum | _____ | _____ |
| Cast iron | _____ | _____ |
| Pitting and etching | _____ | _____ |
| Gum deposit on strips | _____ | _____ |
| 12. Effect on SBR Cups: | | |
| Hardness increase at 158ºF | _____ | _____ |
| Hardness increase at 248º | _____ | _____ |
| Hardness decrease at 158ºF | _____ | _____ |
| Hardness decrease at 248º | _____ | _____ |
| Base diameter change at 158ºF | _____ | _____ |
| Base diameter change at 248º | _____ | _____ |

(Continued on next page)

**15. DATA SHEETS....Continued**

| **INDICATE P - PASS OR F - FAIL** | **PASS** | **FAIL** |
|---|---|---|
| 12. Effect on SBR Cups....Continued | | |
| Disintegration at 158ºF | _____ | _____ |
| Disintegration at 248º | _____ | _____ |
| 13. Stroking Properties | _____ | _____ |
| 14. Color: | | |
| Clear to Amber (DOT 3 & 4) | _____ | _____ |
| Purple (DOT 5) | _____ | _____ |
| 15. Container Sealing: | | |
| Resealable | _____ | _____ |
| Tamper-Proof Feature | _____ | _____ |
| 16. Certification, Marking and Labeling: | | |
| Certification - - | | |
| FMVSS 116 Statement | _____ | _____ |
| Marking - - | | |
| Lot I.D. Code Shown | _____ | _____ |
| Grade Type Shown | _____ | _____ |
| Minimum Wet ERBP Shown | _____ | _____ |
| Complete Mailing Address | _____ | _____ |
| Labeling - - | | |
| Safety Warning Statements | _____ | _____ |
| Removability | _____ | _____ |
| Legibility | _____ | _____ |

COMMENTS:

## 15. DATA SHEETS....Continued

### DATA SHEET 2
### TEST DATA

GROUP NO.: _____ ; LAB.: _____

BRAKE FLUID BRAND: _____; DOT-_____

| Test No. | Test Description | Test Requirements | Test Results | Start Date | Complete Date |
|---|---|---|---|---|---|
| 1* | Boiling Point (ERBP) | Min. = 401ºF | ºF | | |
| 2* | Wet ERBP | Min. = 284ºF | ºF | | |
| 3 | Viscosity at -40ºF | Min = 1500 cSt | cSt | | |
| | Viscosity at 212ºF | Min. = 1.5 cSt | cSt | | |
| 4 | pH Value | 7 to 11.5 | | | |
| 5 | Fluid Stability: | Max. Change | | | |
| | High Temperature | 5.4 +. ) | ºF | | |
| | Chemical | 5.4 +. ) | ºF | | |
| | | ) = 0.05EF/E that BP is > 437EF | ) = _____ EF | | |
| 6 | Corrosion: | | | | |
| | Weight Change, mg/cm² | | | | |
| | Tinned Iron | Max. = 0.2 | | | |
| | Steel | Max. = 0.2 | | | |
| | Aluminum | Max. = 0.1 | | | |
| | Cast Iron | Max. = 0.2 | | | |
| | Brass | Max. = 0.4 | | | |
| | Copper | Max. = 0.4 | | | |
| | Pitting/Roughening | None | | | |
| | Jelling of mixture | None | | | |
| | Crystalline deposits | None | | | |
| | Sedimentation, % by vol. | Max. = 0.10% | | | |
| | Disintegration of cups | None | | | |
| | pH after Test | 7 to 11.5 | | | |
| | Decrease in cup hardness | Max. = 15 IRHD | | | |
| | Increase in cup hardness | Max. = 0.055" | | | |

## 15. DATA SHEETS....Continued

| Test No. | Test Description | Test Requirements | | Test Results | | Start Date | Complete Date |
|---|---|---|---|---|---|---|---|
| 7 | Fluidity and Appearance at Low Temperature: | -40ºF | -58ºF | | | | |
| | Stratification | None | None | | | | |
| | Sedimentation | None | None | | | | |
| | Air Bubble Rise Time - sec. | 10 max | 35 max | | | | |
| 8 | Evaporation: | | | | | | |
| | % Weight Loss | Max. = 80% | | | | | |
| | Gritty Precipitate | None | | | | | |
| | Pour Point of Residue | Max. = 23ºF | | | | | |
| 9 | Water Tolerance: | -40ºF | 140ºF | | | | |
| | Stratification | None | None | | | | |
| | Sedimentation, % | None | .15 max | | | | |
| | Air Bubble Rise Time - sec. | 10 max | | | | | |
| 10 | Compatibility: | -40ºF | 140ºF | | | | |
| | Stratification | None | None | | | | |
| | Crystallization | None | None | | | | |
| | Sedimentation, Sludging, % | None | .05 max | | | | |
| 11 | Resistance to Oxidation: | | | | | | |
| | Weight Loss, mg/cm² | | | | | | |
| | Aluminum | Max. = 0.05 | | | | | |
| | Cast Iron | Max. = 0.30 | | | | | |
| | Pitting/Etching | None | | | | | |
| | Gum Deposits on Strips | Trace | | | | | |
| 12 | Effect on SBR Cups: | 158ºF | 248ºF | | | | |
| | Hardness Increase | None | None | | | | |
| | Hardness Decrease, IRHD | 10 max | 15 max | | | | |
| | Base Diameter Change - in. | 0.006 to 0.055 | 0.006 to 0.055 | | | | |
| | Disintegration | None | None | | | | |
| 13 | Stroking Properties | N/P | | N/P | | | |

## 15. DATA SHEETS....Continued

| Test No. | Test Description | Test Requirements | Test Results | Start Date | Complete Date |
|---|---|---|---|---|---|
| 14 | Color: | | | | |
| | DOT 3 & DOT 4 | Clear to Amber | | | |
| | DOT 5 | Purple | | | |
| 15 | Container Sealing: | Resealable | | | |
| | | Tamper-Proof Feature | | | |
| 16 | Certification: | S116 Statement | | | |
| | Marking - Lot ID Code | Shown | | | |
| | Marking - Grade Type | Shown | | | |
| | Marking - Min Wet ERBP | Shown | | | |
| | Marking - Mailing Address | Complete | | | |
| | Labeling | Safety Warning Statements | | | |
| | | Removability | | | |
| | | Legibility | | | |

* Values shown are for DOT-3 Brake Fluid ONLY. Values for DOT-4 and DOT-5 Brake Fluid are shown below:

| | DOT-4 | DOT-5 |
|---|---|---|
| TEST 1 | 446ºF | 500ºF |
| TEST 2 | 311ºF | 356ºF |
| TEST 3 | 1800cSt | 900cSt |

REMARKS:

RECORDED BY: _____ ; DATE: _____

APPROVED BY: _____

**15. DATA SHEETS....Continued**

## DATA SHEET 3
## STROKING TEST DATA

GROUP NO.: _____ ; LAB.: _____

BRAKE FLUID BRAND: _____

| Test No. | Test Description | Test Requirements | Test Results | Start Date | Complete Date |
|---|---|---|---|---|---|
| 13 | Stroking Properties: | 248ºF | 248ºF | | |
| | Metal | | | | |
| | Pitting/Etching | Max. = None | | | |
| | Diameter Change: | | | | |
| | Piston/Cylinder | Max. = 0.005" | | | |
| | Cylinder/Piston Oper. | Not Frozen | | | |
| | Cups | | | | |
| | Hard Decrease, Average | Max= 15 IRHD | | | |
| | Hard Decrease, One | Max= 17 IRHD | | | |
| | Operating Condition | Satisfactory | | | |
| | Base Diameter, Increase | Max. = 0.035" | | | |
| | Lip Diameter, Set Average | Max. = 65% | | | |
| | Fluid | | | | |
| | Volume Loss/24,000 St | Max. = 36 ml | | | |
| | Volume Loss/last 100 St | Max. = 36 ml | | | |
| | Gel | Max. = None | | | |
| | Sediment Volume | Max. = 1.5% | | | |
| | Abrasive Deposits | Max. = None | | | |

REMARKS:

RECORDED BY: _____ ; DATE: _____

APPROVED BY: _____

**16. FORMS**

## LABORATORY NOTICE OF TEST FAILURE TO OVSC

FMVSS 116 TEST DATE: _____

LABORATORY: _____

CONTRACT NO.: _____; DELV. ORDER NO: _____

LABORATORY PROJECT ENGINEER'S NAME: _____

TEST SPECIMEN DESCRIPTION - -

BRAND NAME & GRADE TYPE: _____

MANUFACTURER OR DISTRIBUTOR: _____

LABEL INFO: _____

PART NO: _____

TEST FAILURE DESCRIPTION: _____

_____

_____

_____

FMVSS REQUIREMENT, PARAGRAPH §___ : _____

_____

_____

_____

NOTIFICATION TO NHTSA (COTR: _____

DATE: _____ BY: _____

REMARKS: _____

## 16. FORMS....Continued

### MONTHLY TEST STATUS REPORT

### FMVSS 116

### DATE OF REPORT: _____

| GROUP NO. | BRAKE FLUID BRAND AND GRADE | TEST START DATE | TEST COMPLETE DATE | PASS/ FAIL | DATE FINAL REPORT SUBMITTED |
|---|---|---|---|---|---|
| 001 | | | | | |
| 002 | | | | | |
| 003 | | | | | |
| 004 | | | | | |
| 005 | | | | | |
| 006 | | | | | |
| 007 | | | | | |
| 008 | | | | | |
| 009 | | | | | |
| 010 | | | | | |
| 011 | | | | | |
| 012 | | | | | |
| 013 | | | | | |
| 014 | | | | | |
| 015 | | | | | |
| 016 | | | | | |
| 017 | | | | | |
| 018 | | | | | |
| 019 | | | | | |
| 020 | | | | | |

REMARKS:

## 16. FORMS....Continued

### MONTHLY INVENTORY STATUS REPORT

### FMVSS 116

### DATE OF REPORT: _____

| GROUP NO. | BRAND NAME | GRADE TYPE | NO. OF SPECIMENS RECVD. | LOT NUMBERS | CONDITION OF SAMPLE | DATE RECEIVED |
|---|---|---|---|---|---|---|
| 001 | | | | | | |
| 002 | | | | | | |
| 003 | | | | | | |
| 004 | | | | | | |
| 005 | | | | | | |
| 006 | | | | | | |
| 007 | | | | | | |
| 008 | | | | | | |
| 009 | | | | | | |
| 010 | | | | | | |
| 011 | | | | | | |
| 012 | | | | | | |
| 013 | | | | | | |
| 014 | | | | | | |
| 015 | | | | | | |
| 016 | | | | | | |
| 017 | | | | | | |
| 018 | | | | | | |
| 019 | | | | | | |
| 020 | | | | | | |

REMARKS:

# APPENDIX A

# INTERPRETATIONS OR DEVIATIONS FROM FMVSS 116

# APPENDIX B

## EQUIPMENT LIST AND CALIBRATION SCHEDULES

TESTING LABORATORY: _____

NOTE: Information to be included for each item of test instrumentation is as follows:

EQUIPMENT DESCRIPTION: _____

EQUIPMENT MANUFACTURER: _____

TYPE AND/OR MODEL: _____

SERIAL NUMBER: _____

LIMITS: _____

ACCURACY: _____

FREQUENCY OF CALIBRATION: _____

EXPIRATION OF CALIBRATION: _____

USED ON TEST NUMBER: _____

REMARKS:

RECORDED BY: _____ ; DATE: _____

APPROVED BY: _____

# APPENDIX C

# PHOTOGRAPHS